CHAPTER 15

PILOT BALLOON OBSERVATIONS

15.1 GENERAL. Pilot balloons are rubber balloons filled with sufficient gas (normally helium, but sometimes hydrogen) to rise at a predetermined rate. The purpose of pilot balloon observations is to determine the direction and speed of the upper winds. Instructions on the filling and release of balloons, plotting of observations, operation and care of equipment, etc., are given in Instrument Manual No. 60.

15.2 TIMES. Pilot balloon observations are made at designated stations up to four times daily. The internationally agreed times of pilot balloon observations are 0000, 0600, 1200 and 1800 UTC.

15.2.1 In Canada the official times of pilot balloon observations may vary from station to station and are scheduled by AES Regional Headquarters.

15.2.2 If twilight or weather does not permit the release at the scheduled time of observation the release should be made up to one hour after the scheduled time if at all possible. For example, if the first release is unsuccessful (e.g., balloon bursting below the lowest reportable wind level) then another release should be attempted if it can be made within an hour of the scheduled time for that observation.

15.2.3 A pilot balloon release shall always be attempted except when the cloud base is below the lowest reportable wind level or when precipitation or an obstruction to vision renders a flight impractical. In such cases, the reason for no observation shall be reported as indicated in para. 15.5.

15.3 COLOURS. Balloons are supplied in two colours, red and clear. Red balloons should be used when there is an appreciable amount of cloud, and/or when the sky is hazy. Clear balloons should be used when the cloud amount is negligible, and when the sky is clear.

15.4 FORM 63–2340 – RECORD OF PILOT BALLOON ASCENT.

15.4.1 Form 63–2340 shall be completed only when a pilot balloon is released and wind data are obtained for at least one of the coded levels above the surface. Where no release is made, or where a release is made and data are not obtained for any of the coded levels above the surface, Form 63–2340 shall not be used. (See instructions on Form 63–2339, para. 15.5).

15.4.1.1 Station Name (in full). Do not use abbreviations or three–letter identifiers.

15.4.1.2 Observer's Name – Recorder's Name. Names shall be printed.

15.4.1.3 Time of Actual Release (UTC). Enter the hours and minutes, e.g., 0515.

15.4.1.4 Rate of Ascent. This entry shall be made only if an ascent rate other than the standard rate of 180 metres per minute is used.

15.4.1.5 Year – Enter the last two digits of the year, e.g., 83 for 1983.

Month – Enter two digits for the number of the month in the year (01 for January, 02 for February, 03 for March, etc.)

Day – Enter two digits for the day of the month based on the scheduled hour of observation UTC (01 for the first day, 02 for the second day, etc.).

Hour – Enter two digits to indicate, to the nearest hour, the actual time of release.

15.4.1.6 Cause of Termination. Enter a check mark in one of the squares (1, 2, 3, 4, 8 or 9) in the section.

15.4.1.6.1 Use "3" (Balloon faded) when distance is the main reason for the loss of the balloon from sight.

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15.4.1.6.2 Use "4" (Cloud or precipitation) when the presence of cloud, precipitation or lithometeors is the main reason for the loss of the balloon from sight.

15.4.1.6.3 Use "8" (Abandoned) for termination of the flight at a pre–established maximum level. Give an explanation in the space on the back of the form under "additional notes."

15.4.1.6.4 Use "9" (Other Causes) for flight termination for any reason other than those listed above. Give an explanation in the space on the back of the form under "additional notes".

15.4.2 Ascent Data. Data obtained during the pilot balloon ascent are entered on Form 63–2340. The aximuth and elevation angles are read from the theodolite at one–minute intervals and entered in the spaces provided. These readings are plotted on the pibal plotting board in accordance with instructions given in Instrument Manual No. 60. At stations equipped with micro–computers the values are entered into the computer and a plotting board is not used.

15.4.3 Computed Values. Wind directions and speeds are determined for each one–minute interval. Upper wind direction and speed observations are plotted against height to provide wind direction and speed information as required for the coded message and for climatological purposes. The Upper Wind Graph Board is used in plotting these data. At stations equipped with micro–computers the values are entered into the computer and a plotting board is not used.

15.4.3.1 Wind directions and speeds shall be read off for the heights specified for the coded message and for "Climatological Data", and entered on Form 63–2340 in the appropriate spaces.

15.4.3.2 Entries are made under 'Climatological Data' only if there is a regional requirement for these data. If so, entries are required as follows:

(a) Three digits shall be used when entering the wind direction, e.g., 2 is entered 002, 21 is entered 021, 145 is entered 145. Calm is entered 000.

(b) At least two digits shall be used when entering the wind speed, e.g., 3 m.p.s. is entered 03, 23 m.p.s. is entered 23, 109 m.p.s. is entered 109. Calm is entered 00.

(c) Wind speeds of less than 1/2 metre per second shall be reported as calm.

(d) Levels which lie below station elevation shall be left blank; levels within the ascent for which wind data are missing shall be indicated by an "M" entry in each of "Direction" and "Speed" Columns.

(e) If the ascent reaches a reportable level required in the coded message but terminates before it reaches the first climatological data level (500 m, 1000 m, 1500 m, etc.) place a large cross within the first four or five climatological data levels to indicate that no data are available. In such cases do not record the surface wind in the climatological data.

15.4.4. Coordinated Universal Time shall be used in determining the beginning and ending of the month. Thus, the earliest possible flight of the month would be at 0000 UTC on the first day of the month.

15.5 FORM 63–2339 – MONTHLY SUMMARY OF PILOT BALLOON OBSERVATIONS.

15.5.1 Form 63–2339 is provided for two reasons:

(a) To record the highest level reached in the coded message for all scheduled flights reaching a reportable coded level above the suface; and

(b) to record the applicable coded reason for 'no observation' for all scheduled observations where no release was attempted, or where the balloon did not reach the first reportable coded level above the surface.

15.5.1.1The coded abbreviation for 'no observation' shall be selected from the list provided on Form 63–2339.

15.5.1.2Thus, an entry shall be made on Form 63–2339 for every scheduled pibal observation for the month.

15.5.2 Station, Province, Month and Year. The station name, province, month and year shall be printed e.g., REGINA A., SASK., JANUARY, 1975.

15.5.3 Coordinated Universal Time shall be used in determining the beginning and ending of the month. Thus, the earliest possible flight of the month would be at 0000 UTC on the first day of the month. Note the instructions at the bottom of Form 63–2339.

15.5.4 Forwarding of Forms 63–2340 and 63–2339. Each month's copies of Form 63–2340 shall be arranged in chronological order with the first flight of the month on top and the last flight of the month on the bottom. These forms for the entire month, together with one copy of Form 63–2339 shall be placed in an envelope, or otherwise securely packaged, and forwarded promptly to the ADMA at the end of each month.

15.6 CODING PILOT BALLOON REPORTS

15.6.1 Upper wind observations from land stations shall be reported by using WMO Code FM 32–IX – PILOT with the exception that for domestic purposes special groups are added to give significant winds, (para. 15.6.3.14). The code name PILOT refers to an upper–wind report from a land station, but is not transmitted as part of the report. A complete PILOT message, giving wind data to levels above the 100 hPa level (approximately 16 000 m) shall be coded in four parts; A, B, C, and D.

15.6.1.1Parts A and B shall include all the coded data up to and including the 100 hPa level (approximately 16 000 m).

15.6.1.2Part C and D shall include the remainder of the coded data to the termination of the ascent.

15.6.1.3Parts A and B are referred to as the FIRST PORTION of the report. Transmission of the FIRST PORTION of the report over the meteorological teletype system must be under the heading UI.

15.6.1.4Parts C and D are referred to as the SECOND PORTION of the report. Transmission of the SECOND PORTION of the report over the meteorological teletype system must be under the h eading UY.

15.6.1.5FIRST PORTION (parts A and B) under the heading UI and SECOND PORTION (parts C and D) may be transmitted sequentially, provided each part UI and UY are fully formatted for transmission as separate reports.

15.6.1.6 These coding instructions apply to Pilot Balloon observations which have been taken using the optical theodolite and no pressure measuring device.

15.6.2

PILOT – UPPER–WIND REPORT

FIRST PORTION

(Data up to and including 100 hPa)

PART A

	Code Format	Contents
(Sect. 1)	$M_iM_iM_jM_j$ YYGGa_4 IIiii	(Identification groups for land stations)
(Sect. 2)	55nP_1P_1 ddfff ddfff ddfff 55nP_1P_1 ddfff ddfff ddfff	(Standard Isobaric Levels) (850, 700, 500, 400, 300, 250, 200, 150 and 100 hPa).
(Sect. 3)	$7H_mH_mH_mH_m$ or $6H_mH_mH_mH_m$	$d_md_mf_mf_mf_m(4VbVbVaVa)$ = (Maximum Wind Data)
	or	
	77999 =	(No Maximum Wind Data)

PART B

	Code Format	Contents
(Sect. 1)	$M_iM_iM_jM_j$ YYGGa_4 IIiii	(Identification groups for land stations)
(Sect. 4)	$9t_nu_1u_2u_3$ ddfff ddfff ddfff ..... $9t_nu_1u_2u_3$ ddfff ddfff ddfff=	(Fixed Regional Levels and Significant Levels)

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PILOT – UPPER–WIND REPORT

SECOND PORTION

(Data above 100 hPa)

PART C

	Code Format	Contents
(Sect. 1)	$M_iM_iM_jM_j$ YYGGA$_4$ IIiii	(Identification groups for land stations)
(Sect. 2)	55nP_1P_1 ddfff ddfff ddfff....	(Standard Isobaric Levels 70, 50, 30, 20, 10, 7 and 5 hPa levels)
(Sect. 3)	$7H_mH_mH_mH_m$ or $6H_mH_mH_mH_m$ } $d_md_mf_mf_mf_m(4VbVbVaVa)$ =	(Maximum Wind Data)
	or	
	77999 =	(No Maximum Wind Data)

PART D

	Code Format	Contents
(Sect. 1)	$M_iM_iM_jM_j$ YYGGA$_4$ IIiii	(Identification groups for land stations)
(Sect. 4)	9 or $t_nu_1u_2u_3$ ddfff ddfff ddfff 1	(Fixed Regional Levels and Significant Levels)
	..... 9 or $t_nu_1u_2u_3$ ddfff ddfff ddfff= 1	

15.6.3

SPECIFICATIONS OF SYMBOLIC LETTERS

AND DETAILED CODING INSTRUCTIONS

PART A

(Data up to and including 100 hPa)

15.6.3.1 $M_iM_iM_jM_j$ – Identification Letters of the Code Form.

15.6.3.1.1 Two identical letters identifying the code form shall be coded for M_iM_i and two identical letters indicating the part of the code form shall be coded for M_jM_j according to the following WMO code:

WMO CODE 2582

		Part of Code Form M_jM_j			
Code Form	M_iM_i	Part A	Part B	Part C	Part D
PILOT	PP	AA	BB	CC	DD

$M_iM_iM_jM_j$ in Part A = PPAA

15.6.3.2 $YYGGa_4$

15.6.3.2.1 YY Day of the Month and Unit of Wind Speed.

(a) The day of the month, according to UTC, on which the observation is taken and the unit of wind speed (i.e., knots or metres per second) being used are reported for symbol YY.

(b) The day of the month is indicated by use of code figures 01 to 31, inclusive, where code figure 01 means the 1st day of the month, 02 means the 2nd day of the month, etc.

(c) The units of wind speed used are indicated as follows:

When wind speeds are given in knots, 50 is added to YY.

When wind speeds are given in metres per second, YY is not modified.

(d) The Atmospheric Environment Service of Canada uses the knot for the unit of wind speed. Therefore, 50 is always added to the code figure determined for the day of the month.

15.6.3.2.2 GG Time of Observation. The time of observation shall be coded to the nearest whole hour. Use the 24 h clock system (00 to 23) based on Coordinated Universal Time. For example, a release time of 0010 UTC would be coded as 00, and a release time of 0030 UTC would be coded as 01.

15.6.3.2.3 a_4 Indicator for Types of Equipment.

(a) The type of equipment used during the ascent to measure upper winds is indicated by the code figure reported for symbol a_4. The appropriate code figure is selected from the following:

Code Figure	Equipment (WMO Code 0265)
0	Pressure instrument associated with wind–measuring equipment
1	Optical theodolite
2	Radio theodolite
3	Radar
4	Pressure instrument associated with wind–measuring equipment but pressure element failed during ascent.

15.6.3.3 IIiii Station Number

(a) Use the International Index Number of the station (five figures).

15.6.3.4 $55nP_1P_1$

15.6.3.4.1 55 Indicator Figures

(a) Indicator figures 55 specify that the winds are reported at altitudes approximating the standard isobaric levels.

(b) Canadian stations use altitude approximations to the standard isobaric levels, prepared for each station and month, based on climatological values. These altitude approximations are furnished individually to the stations, hence they are not repeated in this manual.

15.6.3.4.2 n Number of Standard Isobaric Levels Reported.

(a) The number of consecutive standard isobaric levels for which wind data are being reported, starting with the level specified by P_1P_1, shall be coded for symbol n.

(b) The number of levels reported for n shall not exceed 3. Whenever the number of consecutive levels to be reported is less than 3, the number (i.e., 1 or 2, as appropriate) shall be coded for n.

(c) The number of ddfff data groups following the $55nP_1P_1$ group shall always equal the number coded for n.

Note: Ascent Terminates Below 850 hPa – When the flight terminates before reaching the 850 hPa standard isobaric surface, due to low cloud, etc., Part A shall be omitted from the message. Therefore, the report will consist only of Part B which will contain all the data obtained by the ascent.

15.6.3.4.3 P_1P_1 Indicator for the Lowest Isobaric Level.

(a) The pressure of the lowest standard isobaric level, with respect to altitude, for which wind data are being reported in the ddfff groups specified by n, is coded for symbol P_1P_1.

(b) The pressures of the lowest standard isobaric levels are given in tens of hPa for levels up to and including 100 hPa (i.e., in PART A). For example: The standard isobaric levels of 850, 700, 500, 400, 300, 250, 200, 150 and 100 hPa are reported by code figures 85, 70, 50, 40, 30, 25, 20, 15 and 10 respectively.

(c) Above 100 hPa (i.e., in PART C), the pressures of the lowest standard isobaric levels are given in whole hectopascals. For example: the standard isobaric levels of 70, 50, 30, 20, 10, 7 and 5 are reported by code figures 70, 50, 30, 20, 10, 07 and 05 respectively.

(d) The wind group (i.e., ddfff) is always included in the message for each standard isobaric level being reported for the ascent. If data for a standard isobaric level(s) are missing and data are available for levels above and below the missing level, five solidi (/////) shall be coded for the ddfff group of the level(s) for which data are not available. The use of the five solidi to indicate missing data is necessary to preserve the continuity of the ascending order of the standard isobaric levels in the message.

(e) When any of the standard isobaric levels is below the earth's surface, or within 60 m above the earth's surface, data groups for that level and any lower levels shall be omitted from the message.

Note: The $55nP_1P_1$ group coded as 55385 indicates that wind data (ddfff) for 3 standard isobaric levels will follow, and the first ddfff group will refer to the approximate altitude of the 850 hPa level. The $55nP_1P_1$ group shall be repeated as required to report data for additional standard isobaric levels.

15.6.3.5 ddfff

15.6.3.5.1 dd – wind direction (true) for each standard isobaric level for which data are available.

(a) The wind direction is coded to the nearest 5°. This requires the use of the entire 5–figure group (i.e., both the direction and the speed). The observed wind direction is rounded off to the nearest 5° before coding (e.g., 293° is rounded off to 295° before coding; 292° is rounded off to 290° before coding). The wind direction is then coded in two steps as follows:

1. The hundreds and tens digits of the rounded direction are coded for the dd series of symbols.

2. The rounded units digit of the direction (i.e., 0° or 5°) is added to the hundreds digit of the wind speed and the sum is coded for fff. for example:

A wind speed and direction of 293°/162 knots would be coded as

295
+162
ddfff = 29662

A wind speed and direction of 282°/20 knots would be coded as

280
+ 020
ddfff = 28020

(b) When the air is calm, code figures 00 shall be reported for the direction.

(c) When the direction is missing for a specified level, solidi (//) shall be coded for direction.

15.6.3.5.2 fff

(a) fff – represents the wind speed in knots at each standard isobaric level for which data are available.

(b) Code as per instructions in para. 15.6.3.5.1 (2).

(c) When the air is calm, code figure 000 shall be reported for the speed.

(d) When the speed is missing for a specified level, solidi (///) shall be coded for speed.

15.6.3.6. $6H_mH_mH_mH_m$

or

$7H_mH_mH_mH_m$

15.6.3.6.1 6 or 7 is used as an indicator to identify maximum wind data in Parts A and/or C of the message.

(a) Indicator 6 is used to identify a maximum wind at the terminating level only of the wind sounding, provided that the maximum wind speed:

(i) occurs above the 500 hPa level

(ii) is the highest speed observed throughout the sounding

and

(iii) is greater than 60 knots.

Note: The maximum in this case does not completely satisfy the criteria in para. 15.6.3.6.3 (a) in so far as the greatest speed occurs at the terminating level of the sounding.

(b) Indicator 7 is used to identify a maximum wind at a level below the terminating level of the wind sounding, provided the maximum wind speed satisfies the criteria given in paras. 15.6.3.6.3 (a) and (b).

15.6.3.6.2 $H_mH_mH_mH_m$ Altitude of Maximum Wind.

(a) The altitude of the level of the maximum wind is reported for symbol $H_mH_mH_mH_m$.

(b) The altitude is reported in increments of decametres. For example: If the maximum wind occurs at 12 000 m, code figure 1200 is reported for $H_mH_mH_mH_m$. Conversely, the altitude of the level of maximum wind in increments of 300 m is obtained from the coded report by dividing the value reported by $H_mH_mH_mH_m$ by 30, i.e., $1200 \div 30 = 40$.

15.6.3.6.3 Maximum Wind Data

(a) A level of maximum wind is defined as a plotted level at which the wind speed is greater than at those plotted levels adjacent to it (i.e., at levels immediately above and below it). If the highest wind speed occurs in a layer of equal wind speeds (i.e., two or more adjacent plotted levels with the same wind speed), then the plotted level at the top of the maximum wind layer shall be designated as the maximum wind.

(b) In Part A of the message, the maximum wind reported shall be the maximum wind, as defined in para. 15.6.3.6.3 (a) with the highest speed greater than 60 knots, occurring above 500 to and including 100 hPa. If this wind occurs at more than one level, the highest with respect to altitude shall be reported.

(c) In Part C of the message, the maximum wind reported shall be the maximum wind as defined in para 15.6.3.6.3 (a) with the highest speed greater than 60 knots occurring above 100 hPa. If this wind occurs at more than one level, the highest with respect to altitude shall be reported.

(d) Maximum wind data occurring at or below 100 hPa shall always be reported in Part A of the message, and maximum wind data occurring above 100 hPa shall always be reported in Part C.

15.6.3.7 $d_m d_m f_m f_m f_m$ – Direction and Speed of Maximum Wind

15.6.3.7.1 $d_m d_m$ – direction of maximum wind; code as per instruction for dd, para. 15.6.3.5.1 (a) (1) and (2).

15.6.3.7.2 $f_m f_m f_m$ – speed in knots of maximum wind. Code as per instructions for fff, para. 15.6.3.5.1 (2).

15.6.3.7.3 $4v_b v_b v_a v_a$ – Vertical Wind Shear Data. The symbols $4v_b v_b v_a v_a$ represent vertical wind shear data in zones of maximum wind. These data shall not be reported by the Atmospheric Environment Service of Canada at the present time.

15.6.3.8 77999 – No Maximum Wind Data

15.6.3.8.1 If for any reason (and regardless of the height of the ascent) a Maximum Wind is not observed in the stratum covered by Part A or the stratum covered by Part C, the indicator group 77999 will be coded for either or both Parts, as appropriate. The 77999 indicator group notifies the recipient that a Maximum Wind was not observed with respect to the Part in which the group appears.

15.6.3.9= Message Separation Signal

15.6.3.9.1 The message separation signal is inserted in the message as indicated in the symbolic forms of messages to mark the termination of a particular portion of the report. The separation signal is always added, without a space intervening, to the last data group of that portion of the report so that in most instances the last group will become a six character group.

15.6.3.9.2 The separation signal is always added at the end of PARTS A, B, C, and D of both the land and ship forms of messages. It is also added at the end of all other types of messages containing observed upper wind data as specified; e.g., messages containing corrective data, missing data, etc.

15.6.3.9.3 By international agreement the message separation signal was devised for use in connection with the automatic processing of data by electronic equipment in both meteorological and telecommunications operations. Therefore, the inclusion of the message separation signal, in its correct position, is essential to the efficient operation of that equipment.

PART B

(Data up to and including 100 hPa)

15.6.3.10 $M_iM_iM_jM_j$ refer para. 15.6.3.1.1.

$M_iM_iM_jM_j$ in Part B = PPBB

15.6.3.11 $YYGGa_4$ – same as in Part A, para. 15.6.3.2 (Day, hour UTC and type of equipment).

15.6.3.12 IIiii (International Index Number) para. 15.6.3.3.

15.6.3.13 $9t_nu_1u_2u_3$ – Identifies fixed Regional and/or significant levels; refer para. 15.6.3.14 and 15.6.3.15.

15.6.3.13.1 9 – indicator figure used to specify altitudes in increments of 300 m.

15.6.3.13.2 t_n – Tens Digit of Number of Altitude Increments.

(a) The tens digits of the total number of 300 m increments of altitude of a fixed Regional level or a significant level is reported for symbol t_n. Thus, if the tens digit of the number of increments is zero, as in the case of altitudes from mean sea level to 2700 m (9 increments of 300 m), code figure "0" is reported for t_n. From 10 increments of 300 m to 19 increments of 300 m inclusive (3000 m to 5700 m), code figure "1" is reported for t_n. From 20 increments of 300 m to 29 increments of 300 m inclusive (6000 m to 8700), code figure "2" is reported for t_n, etc.

(b) Three levels can be reported by a $9t_nu_1u_2u_3$ group; however each time the value of the tens digit represented by symbol t_n changes, another $9t_nu_1u_2u_3$ group must be inserted in the message. Therefore, a $9t_nu_1u_2u_3$ group can specify one, two, or three levels and would be followed by one, two, or three corresponding ddfff data groups, as appropriate.

15.6.3.13.3 $u_1u_2u_3$Units Digit of Number of Altitude Increments.

(a) The units digit of the total number ofincrements of altitude of a fixed Regional levelor significant level is coded for symbol $u_1u_2u_3$.

(b) Symbol u_1 is the units digit of the total number of increments of altitude which applies to the first data group following.

(c) Symbol u_2 is the units digit of the total number of increments of altitude whichapplies to the second data group following.

(d) Symbol u_3 is the units digit of the total number of increments of altitude whichapplies to the third data group following.

Note: When an altitude is coded directly in increments of 300 m the coded value is a close approximation of the altitude in thousands of feet. For example: 20 increments of 300 m (6000 m) = 19686 ft.

(e) A solidus (/)shall be coded for u_2 and/or u_3 when an actual level value is not available for these symbols. When a solidus (/) is coded for either u_2 and/or u_3 the corresponding ddfff data group(s) shall be omitted from the message.

(f) When data are missing for a fixed Regional level, its u symbol and the corresponding ddfffdata group are omitted from the message. Due to the use of the $9t_nu_1u_2u_3$ group, it is not necessary to use missing data indicators to preserve the ascending continuity of the message in order to determine the altitude of levels above the missing levels(s).

(g) As the wind at the earth's surface isa specified significant level (15.6.3.15), it is always reported in the first ddfff data group of Section 4, PART B. Therefore,code figure 0 is always coded for the first u_1 symbol of Section 4 of PART B so that the recipient will be able to identify the surface wind.

(h) As the termination level of the sounding (i.e., the highest 300 m increment level) is specified as a significant level, it is always reported as the last ddfff data group of Section 4 of either PABT B or PART D, as appropriate.

15.6.3.14 Fixed Regional Levels

15.6.3.14.1 When available, wind data are always reported for the fixed Regional levels listed below:

In PART B: (Below 100 hPa)

Metres		Metres		Metres		Metres	
300	(1)	1800	(6)	3600	(12)	7 500	(25)
600	(2)	2100	(7)	4200	(14)	9 000	(30)
900	(3)	2400	(8)	4800	(16)	10 500	(35)
1200	(4)	2700	(9)	6000	(20)	15 000	(50)

IN PART D: (Above 100 hPa)

Metres	
21 000	(70)
27 000	(90)
30 000	(100)
33 000	(110)
42 000	(140) and every 3000 m increment above 42000 m.

Notes: (1) The bracketed values above are the equivalent altitudes expressed in increments of 300 m.

(2) Generally, the levels which very closely approximate the altitude of the standard isobaric surfaces are omitted.

15.6.3.14.2 Data for the fixed Regional levels shall be obtained from the curves plotted on the Winds Aloft Graph Sheet at the specified level, except where para. 15.6.3.15.8 or 15.6.3.15.9 applies.

15.6.3.14.3 If any of the fixed Regional levels is below the earth's surface, data groups for that level and any lower level(s) shall be omitted from the message.

15.6.3.14.4 When the station elevation is less than 60 m below a fixed Regional level, the data groups for that level shall be omitted from the message. For example, a station at 550 m elevation shall not include data for the 300 m and 600 m levels. The first fixed Regional level for which that station reports data shall be the 900 m level.

15.6.3.14.5 Wind data for the fixed Regional levels shall be reported in the form $9t_nu_1u_2u_3$ ddfff ddfff ddfff . . . . in sequential order.

15.6.3.15 Significant Wind Levels

15.6.3.15.1 Significant wind levels shall be slected from the plotted curves on the Winds Aloft Graph Sheet to meet the following criteria:

(a) When data for the selected significant wind levels alone are plotted, the direction and speed curves reproduce the prominent features of the measured wind profile;

(b) These curves reproduce the measured wind profile in such a way that the direction at any level between two adjacent transmitted significant levels shall not differ by more than 10° nor the speed by more than 10 knots from that obtained by linear interpolation between the two significant levels;

(c) The number of significant levels is kept to a necessary minimum.

15.6.3.15.2 The surface level and the highest level attained by the sounding constitute the first and last significant levels, and are always included in the message.

15.6.3.15.3 The highest level of the sounding is defined as the highest 300 m increment level for which observed data are available. For example, if the plotted data on the Winds Aloft Graph Sheet terminated at 11340 m, the highest level by definition would be 11,100 m, i.e., 37 increments of 300 m.

15.6.3.15.4 The boundary levels of a missing stratum (containing more than three minutes of missing wind data) shall be selected as significant at the first plotted minutes (i.e. levels for which actual wind speeds were evaluated and plotted) immediately adjacent to the missing stratum –Use the normal rounding off procedures for coding the altitude of these levels.* For example, if the boundaries of a missing stratum were plotted at 5300 m and 6400 m, wind altitudes for the lower and upper boundaries would be coded as 18 and 21 increments of 300 m respectively.

15.6.3.15.5 A level with the greatest wind speed throughout the sounding shall be slected as significant. If there are two or more such levels, the highest with respect to altitude shall be selected.

15.6.3.15.6 Additional significant wind levels shall be selected so that linear interpolation between any two transmitted significant levels gives a close approximation of the observed data, as defined in para. 15.6.3.15.1 (b).

15.6.3.15.7 Except for the significant levels outlined in para. 15.6.3.15.2, whenever possible, significant levels should be selected at extremes in the curve. An extreme is defined as a point at which the vertical gradient of the parameter changes its sign, i.e., a point at which the trend of the curve is reversed.

15.6.3.15.8 When a significant wind level occurs at plus or minus 150 m or less of a fixed Regional level, the speed and direction of the significant level wind shall be reported in that fixed level group in lieu of the data observed at the fixed Regional level.

15.6.3.15.9 If in applying the above rule, the significant wind is equidistant to two adjacent fixed Regional levels, the significant wind data are reported in lieu of the data for the higher fixed Regional level. For example, if the significant wind level occurs at 2250 m, the significant wind data would be assigned to the 2400 m fixed Regional level.

15.6.3.15.10 Wind data for the significant levels shall be reported in the proper $9t_nu_1u_2u_3$ ddfff ddfff ddfff group in sequential order with the fixed Regional levels.

*Note: If two significant levels are rounded off to the same 300 m increment, then the level that best reflects the profile of the wind speed and direction curves shall be selected as significant for coding.

15.6.3.15.11 Since the altitude increment used is 300 m, the altitude of the significant wind data shall be reported to the nearest 300 m and the standard rounding off procedure shall apply. When the altitude of a significant wind is equidistant to two 300 m increment levels the higher 300 m increment level is used in the coding except with respect to the highest level of the sounding which is always the highest 300 m level for which observed data are available. (refer para. 15.6.3.15.3).

15.6.3.15.12 The following method of selecting significant levels is suggested:

(a)The surface level and the highest level attained by the sounding constitute the first and last levels.

(b)The deviation from the linearly interpolated values between the first and last levels is then considered. If no direction deviates by more than 10° and no speed by more than 10 knots, no other significant level need be reported. Whenever one parameter deviates by more than the limits specified above, the level of greatest deviation becomes a supplementary significant level for both parameters.

The levels of greatest deviation shall always include the extremes of the speed curve.

Note: An extreme is understood to be a point where the vertical gradient of the parameter changes its sign, i.e., a point at which the trend of the curve is reversed.

(c)The additional significant levels so introduced divide the sounding into several layers. In each separate layer, the base and the top are then considered. The process given in para. 15.6.3.15.12(b) is repeated and yields other significant levels. These additional levels in turn modify the layer distribution, and the method is applied again until any level is approximated to the above mentioned specified values.

15.6.3.16 ddfff–Wind direction and speed at fixed Regional and/or significant levels below 100 hPa. Refer to para. 15.6.3.5.

Note: The message separation signal = shall be used to designate the end of Part B. Refer to instructions in para. 15.6.3.9.

PART C

(Data above 100 hPa)

15.6.3.17 $M_iM_iM_jM_j$ – Message identifier – coded in Part C as PPCC, para. 15.6.3.1.1.

15.6.3.18 $YYGGa_4$ – Same as in Part A. Day, Hour UTC and Type of Equipment. Coded as in para. 15.6.3.2.

15.6.3.19 Iliii – International Index Number.

15.6.3.20 $55nP_lP_l$ – For coding instructions refer to para. 15.6.3.4.

Note: P_lP_l – Indicator for the lowest isobaric surface – may refer in Part C to the standard isobaric surfaces of 70, 50, 30, 20, 10, 7, and 5 hPa and would be reported by code figures 70, 50, 30, 20, 10, 07, and 05 respectively.

15.6.3.21 ddfff – Wind direction and speed for each standard isobaric level for which data are available; for coding instructions refer para. 15.6.3.5.

15.6.3.22 $6H_mH_mH_mH_m$ Data for maximum wind above 100 hPa.
or For coding, refer to para. 15.6.3.6.
$7H_mH_mH_mH_m$

15.6.3.23 $d_md_mf_mf_mf_m$ – Direction and speed of maximum wind above 100 hPa. For coding refer to para. 15.6.3.7.

($4V_bV_bV_aV_a$) Vertical Wind Shear Data (not coded, Para.15.6.3.7.3).

15.6.3.24 77999 – No maximum wind data.

Note: The message separation signal = shall be used to designate the end of Part C. Refer to instructions para. 15.6.3.9.

PART D

15.6.3.25 $M_iM_iM_jM_j$ – message identifier – coded in Part D as PPDD, para. 15.6.3.1.1.

15.6.3.26 $YYGGa_4$ – Same as in Part A – Day, Hour UTC, and Type of Equipment – refer to para. 15.6.3.2.

15.6.3.27 Iliii – International Index Number.

15.6.3.28	$9t_nu_1u_2u_3$	Identifies fixed Regional and/or signifi
or	cant levels (above 100 hPa). For coding	
1	refer to para. 15.6.3.13. Fixed Regional Levels above 100 hPa are given in para. 15.6.3.14.1	
15.6.3.28.1	9	The indicator figures 9 and 1 (i.e., fig–
	or	ure 9 or 1 used with the $t_nu_1u_2u_3$ group)
	1	specify that data for fixed Regional and
	significant levels follow. These figures also indicate that the altitudes being re– ported are in increments of 300 m. The indicator figure shall be inserted in the positions specified in Parts B and D of both the land and ship forms of the mes–	
sage.		

15.6.3.28.2 Indicator figure 9 shall be reported for altitudes up to and including 29 700 m.

15.6.3.28.3 Indicator figure 1 shall be reported for altitudes above 29 700 m. When decoding, the indicator figure 1 specifies that 30 000 m shall be added to all altitudes indicated by $t_nu_1u_2u_3$.

15.6.3.28.4 Fixed Regional and significant levels selected at and below 100 hPa are reported in Part B of the message. The remainder of the coded levels to the termination of the ascent are reported in Part D of the message.

15.6.3.28.5 t_n – the tens digit of the altitude, expressed in increments of 300 m, of a fixed Regional level or a significant level is reported for symbol t_n. Thus, if the tens digit of the altitude expressed in increments o f 300 m is zero, as in the case of altitudes from mean sea level to 2700 m inclusive, code figure 0 shall be reported for t_n. From 3000 m to 5700 m inclusive, code figure 1 shall be reported for t_n. From 6000 m to 8700 m code figure 2 is reported for t_n, etc. From 30 000 to 32 700 m, inclusive code figure 0 shall be reported for t_n. From 33 000 to 35 700 m inclusive code figure 1 shall be reported for t_n, etc.

15.6.3.28.6 Three levels can be reported by a $9t_nu_1u_2u_3$(or $1t_nu_1u_2u_3$) group; however each time the value of the tens digit represented by symbol t_n changes, another $9t_nu_1u_2u_3$ (or $1t_nu_1u_2u_3$) group must be inserted in the message. Therefore, a $9t_nu_1u_2u_3$ (or $1t_nu_1u_2u_3$) group can specify one, two, or three levels and can be followed by one, two or three corresponding ddfff groups, as appropriate.

15.7 TRANSMISSION OF THE PILOT MESSAGE

15.7.1 Transmission of the PILOT message on Meteorological communications circuits shall be in conformity with the instructions outlined in TELPRO for the transmission of UI/UY reports into the computer–switched teletype system. A ll PILOT messages shall be input individually into the system and a station filing both a UY and a UI report shall transmit two reports under separate headings, e.g., UI OD DATE/TIME. Each of parts A and B of the UI report, and each of parts C and D of the UY report, within the input format (No. 8) shall be terminated by the Separation Signal "=". Refer to instructions in para. 15.6.3.9.2.

15.7.2 No Observation Reports. When an observation is not available at the scheduled transmission time, the observer shall file a report stating that there will be no observation, or that the observation has been delayed.

15.7.2.1 A "No Observation Report" shall consist of the Identification groups and the appropriate abbreviation selected from the following list:

FINO – Scheduled report will not be available.

DLAD – Scheduled report will be available, but delayed.

15.7.2.2 A "No Observation Report" shall have the following symbolic form:

M_iM_i YYGGa_4 Iliii ABBREVIATION=

15.7.2.3 If, for example, at Winnipeg it was impossible to take an observation on August 20 at 0615 UTC due to low clouds, the "no observation" report, within the proper format, would be:

PP 70061 71852 FINO=

15.7.3 Diagrams, para. 15.7.3.3 and para. 15.7.3.4, illustrate data obtained from a pilot balloon flight to 20 940 m, and the coded PILOT message Parts A, B, C, and D, derived from these data.

15.7.3.1 The altitudes associated with standard isobaric levels shown in Parts A and C pertain only to Calgary during the month of January. Refer to para. 15.6.3.4.1 (b).

15.7.3.2 The altitudes shown in bold type in Parts B and D represent fixed Regional levels. The altitudes in lighter type, i.e., 8400 m, and 9600 m and 11 700 m in Part B and 20 700 m in Part D represent significant wind levels.